Impact of Materials Selection on Graphoepitaxial Directed Self-assembly for Line-space Patterning

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Directed self-assembly (DSA) of block copolymers (BCPs) is a promising technology for advanced patterning at future technology nodes, but significant hurdles remain for commercial implementation. While chemoepitaxy processes employing poly(styrene-block-methyl methacrylate) (PS-PMMA) are most widely studied for DSA line/space patterning, graphoepitaxy processes using more strongly segregated “high-X;” block copolymers have recently shown a lot of promise and give lower defectivity and line-width roughness (LWR) than comparative chemoepitaxy processes. This talk will report on some of the design considerations for optimizing line/space patterning with these materials. We have found that brush and block copolymer selection are critical to achieve high quality DSA. For example, brush thickness must be optimized to achieve matching space critical dimensions, and brush surface energy impacts kinetics of assembly. The X parameter of the block copolymer must also be optimized to balance LWR, kinetics of assembly, and process window. These materials and processes will be discussed and ultimately compared to a competitive process for 16 nm patterning.